Blockchain Technology in Healthcare

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Blockchain technology, a distributed ledger based on peer to peer networks, has been gaining high popularity in healthcare.

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1. Introduction

Blockchain technology, a distributed ledger based on peer to peer networks ^[1], has been gaining high popularity in healthcare ^{[2][3]}. This high popularity has resulted from the innovative advantages of blockchain technology in managing medical data when compared to conventional methods. For example, blockchain technology can enhance not only the security of patients' medical data in hospitals ^{[4][5]}, but also the safety of their medical data transfer between hospitals ^{[6][7]}. It can ensure that patients have unrestricted access to their own medical data whenever and wherever they require ^[6].

Furthermore, blockchain technology can provide innovative medical services for both patients and healthcare organizations through technological convergence with cutting edge information technology (IT) such as cloud technology ^{[Z][8]}, internet of things (IoT) ^{[9][10]}, big data ^[11], and smart devices ^[10]. Therefore, more and more researchers and practitioners in healthcare are paying special attention to blockchain technology. This interest has recently brought about many studies on blockchain technology in healthcare, creating high demand for quantitative or qualitative reviews on the main research streams thereof. In order to contribute to satisfying this high demand for the reviews, this research conducts not only a quantitative review but also a qualitative review on studies about blockchain technology in healthcare. For the quantitative review, this research analyzes the main research streams in terms of their distribution by publication year, language, country of origin, journal, and the annual average numbers of citations. For the qualitative review, this research examines the contents of the top ten studies ranked by their annual average numbers of citations through the lens of Leavitt's diamond model ^[12].

2. Future Direction

Future research regarding blockchain technology in the healthcare domain as follows.

First, it is desirable for future studies to pay more attention to the use of the people approach or the structural approach. Our qualitative review results point out that most of the top ten articles adopted the technological approach by concentrating on blockchain-based solutions to current issues in managing medical data without analyzing the impacts of blockchain technology on the people, structure, and task of healthcare organizations in the integrative perspective of Leavitt's diamond model ^[12]. As emphasized by Leavitt ^[12], the technology is a major factor that can transform healthcare organizations, but the inter-relationships between people, technology, structure, and task can ultimately determine the success of blockchain technology may provide to healthcare organizations. No matter how effective the solutions that blockchain technology may provide to healthcare organizations are, the solutions can hardly succeed without considering the harmony of the blockchain-based solutions with the people, structure, and task of healthcare organizations ^[12]. Therefore, the scope of the major research streams—which mainly focus on the technological approach —can be widened by illuminating a way to ensure harmony by adopting the people approach or the structural approach in future studies.

Second, it is worthwhile to pay special attention to the technology convergence of blockchain technology with cloud technology or IoT in the contents of the top ten articles, as revealed by this review. The majority of the top ten articles suggested blockchain-based solutions with the convergence of blockchain technology with cloud technology or IoT. Blockchain technology has both strengths and limitations ^[1], facing potential challenges which must be overcome for

successfully managing medical data in the healthcare domain ^[8]. Therefore, the major research streams in blockchain technology in healthcare can be deepened by illuminating new ways of complementing its limitations with the strengths of other technologies through technology convergence.

Third, there is a high demand for an interdisciplinary approach of future studies on blockchain technology in healthcare. It would be effective for future studies to adopt an interdisciplinary approach, rather than a monodisciplinary approach, to provide innovative ways of managing medical data for healthcare organizations. Various views from multiple experts of not only healthcare but also of IT, human psychology, organizational structure, and task are necessary to more accurately analyze the influences of blockchain technology on the people, structure, and task of healthcare organizations and more effectively create blockchain-based solutions for issues of managing medical data.

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